



STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES &
ENVIRONMENTAL CONTROL
DIVISION OF WATER
89 KINGS HIGHWAY
DOVER, DELAWARE 19901

Fact Sheet – November 1, 2018

Board of Public Works
City of Lewes
107 Franklin Avenue
Lewes, Delaware 19958

NPDES Permit No. DE 0021512
Permit No. WPCC 3075H/74

The Board of Public Works of the City of Lewes has applied for reissuance of its National Pollutant Discharge Elimination System (NPDES) permit to discharge treated wastewater from its sanitary wastewater treatment facilities to the Lewes segment of the Lewes-Rehoboth Canal.

Proposed Changes

1. Added new Electronically Generated Discharge Monitoring Report (eDMR) requirements.
2. Revised Special Condition No. 8 to include updated language outlining wastewater treatment plant operator licensing requirements.
3. Revised Special Condition No. 9 to require the permittee to continue to implement and maintain a Nutrient Offset Plan in order to offset the small amount of nutrients (nitrogen and phosphorus) that modelling suggests is discharged to the Inland Bays from the facility.
4. Added New Special Condition No. 11 requiring the permittee to demonstrate a minimum of 92.5% reduction in the raw waste TSS and BOD₅ concentrations on a monthly average basis prior to discharge.
5. Added New Special Condition No. 12 based on our review of 40 CFR Part 136 to ensure the use of EPA-approved analytical methods that are capable of detecting and measuring the pollutants at, or below, the applicable water quality criteria or permit limits.
6. Added a standard condition in Part II.A.2, "Notifications Specific to Manufacturing, Commercial, Mining, and Silvicultural Dischargers".
7. Added existing storm water outfall (SW001) to Part I.B.2 of the permit.

Facility Location

The facility is located at 116 American Legion Road, Lewes, Sussex County, Delaware.

Activity Description

The facility is a municipal wastewater treatment facility that receives wastewater from the City collection system, provides treatment, and discharges to the Lewes segment of the Lewes-Rehoboth Canal. The facility is designated as major publicly owned treatment works (POTW) based on the design flow of over one million gallons per day. There are no industrial waste contributors to the collection system, and no combined sewer overflows (CSO).

Discharge Description

One wastewater discharge point (Outfall 001) is present at the site. Wastewater treatment consists of a 5 millimeter (mm) band screen, grit removal, flow equalization, 2 mm band screen, membrane biofiltration process, and U.V disinfection. Waste sludge is stabilized, dried on porous asphalt drying beds and/or vacuum sludge press, and disposed at a landfill. One storm water outfall (SW001) also discharges from the site.

Receiving Stream Classification

The facility discharges to the Lewes segment of the Lewes-Rehoboth (LR) Canal. The LR Canal is a tidal salt water body. The designated uses for the LR Canal are: industrial water supply; primary contact recreation; secondary contact recreation; and maintenance of fish, aquatic life, and wildlife.

A May 1994 report entitled, "Hydrodynamics and Eutrophication Model Study of the Indian River and Rehoboth Bay, Delaware, prepared by C.F. Cerco found that the flow direction of the LR Canal in the vicinity of the Lewes STP was northward to the Delaware Bay since it concluded that the Lewes STP nutrient loads were "not considered as a load to Rehoboth Bay." Please note that not including the discharge from Lewes by Cerco was not based on any scientific finding. This assumption was made in order to simplify modeling. Another study performed in 1999 by Kuo-Chuin Wong of the College of Marine Studies resulted in a report entitled, "Current Measurements in the Lewes-Rehoboth Canal". This report indicates that the mean current at the northern end of the LR Canal approximately 2 miles south of the Lewes STP discharge shows a strong northward trend. The report states that the amplitude of the dominant current at the northern end of the canal is 50% stronger than that at the southern end of the canal. The mean current at the Lewes STP discharge is likely to exhibit an even stronger northward trend. The conclusions of the report indicate that the predominant flow in the Lewes segment of the LR Canal is toward the Delaware Bay. An additional dye study was performed in the summer of 2003 at the request of the City of Lewes by Hall & Associates. This study resulted in a report entitled, "Dye Study Investigation of Effluent Transport in the Lewes-Rehoboth Canal under Summer Conditions", dated December 8, 2003. This report concluded that only a small amount (0.3 - 5%) of effluent from the Lewes STP discharges to Rehoboth Bay. The majority of the effluent (95 - 99%) flows to Roosevelt inlet and into the Delaware Bay. Based on this information, the discharge from the Lewes STP will be considered to discharge on average 2.5% to the Rehoboth Bay and 97.5% to the Delaware Bay.

Statutory and Regulatory Basis

The Delaware Department of Natural Resources and Environmental Control (DNREC) proposes to reissue an NPDES permit to discharge the wastewater subject to certain effluent discharge limitations, monitoring requirements and other terms and conditions identified in the draft permit. Section 402 of the federal Clean Water Act, as amended, and 7 Del. C. Chapter 60 provide the authority for permit issuance. Federal and state regulations promulgated pursuant to these statutes are the regulatory bases for permit issuance.

Bases for Effluent Limitations

DNREC has examined the application, recent discharge monitoring data, and related information. The Department proposes to reissue the facility's NPDES permit for a period not to exceed five (5) years, subject to the effluent discharge limitations and monitoring requirements shown in the attached permit.

The following table indicates the bases for effluent limitations for Outfall 001:

Bases for Effluent Limitations – Outfall 001				
Parameter	Water Quality- Based	Technology Based	Performance Based	Monitoring Only
		RGCWP ⁽²⁾		
Flow				X
Dissolved Oxygen				X
pH		§7.7.3		
Enterococcus	SWQS ⁽¹⁾ §4.5.7.1		X	
BOD ₅		§7.7.3		
Total Suspended Solids (TSS)		§7.7.3		
Total Nitrogen	TMDL			
Total Phosphorus	TMDL			
Biomonitoring				X
1. State of Delaware, Surface Water Quality Standards (SWQS), 2. State of Delaware, Regulations Governing the Control of Water Pollution (RGCWP).				

Flow

The current permit has no flow limit but includes a note stating, “The hydraulic design discharge rate of 1.5 million gallons per day (MGD) was used in determining the effluent limitations for this outfall.” The hydraulic design discharge rate is used to calculate load limits for effluent parameters from the concentration limits. The continuous flow measurement frequency has been retained.

pH

Technology-based pH limits and once daily monitoring requirements have been retained from the current permit. These limits are based on Section 7.7.3 of the Regulations Governing the Control of Water Pollution (RGCWP).

Enterococcus

The current permit includes water quality based effluent limitations and monitoring requirements for enterococcus based on Section 11.6 of the State of Delaware SWQS, as amended, August 11, 1999. Section 4.5.7.1 of the current SWQS, as amended November 1, 2014, allows enterococcus limits of 35 colonies per 100 mL (Daily Average) and 104 colonies per 100 mL (Daily Maximum). Based on facility performance during the current permit term, the current enterococcus effluent limitation and once weekly monitoring frequency have been retained. In addition to the daily average effluent limitation, a daily maximum effluent limitation for enterococcus has been added based on the Single Sample Value criteria in §4.5.7.1 of the SWQS.

BOD₅

Technology-based BOD₅ limits and once weekly monitoring requirements have been retained from the current permit. These limits are based on Section 7.7.3 of the Regulations Governing the Control of Water Pollution (RGCWP).

Total Suspended Solids (TSS)

Technology-based TSS limits and once weekly monitoring requirements have been retained from the current permit. These limits are based on Section 7.7.3 of the Regulations Governing the Control of Water Pollution (RGCWP).

TSS and BOD₅ Removal Requirements

40CFR§133.102(a)(3) and (b)(3) require a minimum of 85% reduction in the raw waste BOD₅ and TSS on a monthly average basis prior to discharge. Further, based on our review of the RGCWP, §7.7.3 of the regulations requires 92.5% removal of BOD₅ and TSS for facilities employing secondary treatment, filtration, and disinfection. This requirement has been added to the permit in Part III. A., Special Condition No.11.

Nutrients

The Inland Bays TMDL requires that point source nutrient discharges to the Inland Bays be systematically eliminated. Since an estimated 2.5% of the discharge from the facility reaches the Inland Bays, the facility will be permitted to continue to discharge nutrients, while eliminating or offsetting 2.5% of the actual nutrient load to account for the portion of the overall load that reaches the Inland Bays.

The Inland Bays Pollution Control Strategy (PCS) requires 2:1 offsets (i.e. 2 lb reduction: 1 lb credit) for non-point source reductions in nutrients within the watershed. So the permittee must achieve 5% offsets for the 2.5% of its total discharge, for the actual amounts of its TN and TP that reach the Inland Bays. Accordingly, the permittee shall be allowed to discharge up to the currently permitted 100 lb/day (36,500 lb/year) of Total Nitrogen (TN) and 25 lbs/day (9,125 lb/year) of Total Phosphorus (TP), while offsetting 5% of the actual amounts of TN and TP discharged.

Special Condition No. 9 in the current permit authorized the use of manure relocation to accomplish the required offsets with a later transition to more permanent solutions such as agricultural to riparian forest conversions, agricultural to grassed buffer conversions, and/or wetland restoration of land previously converted to agricultural use. The permittee investigated several options for long term offsets including agricultural land conversions, wetland conversions, and oyster aquaculture. The agricultural land and wetland conversion options were not pursued further due to the cost and availability of land in the watershed, as most of the land available is being acquired for residential and commercial usage. The oyster aquaculture option was investigated and the permittee submitted a proposal to the Department via letter dated, November 13, 2013. Based on subsequent discussions and a meeting held on April 21, 2014, it was agreed that the proposed offset program based on oyster aquaculture was not currently feasible. The Department and the permittee agreed that manure relocation was to be continued as the means of offsetting the small amount of nutrients that modelling suggests is discharged to the Inland Bays from the facility. The Department formally approved the continuation of manure relocation for nutrient offsets via letter dated, May 14, 2014.

The offset program began in 2009 when the permittee established an Offset Reserve through the relocation of 358.67 tons of chicken manure from farms in the Inland Bays watershed for use at locations outside the watershed. From the program inception through March 2018, the balance of the Offset Reserve has been reduced by 11.8 pounds of manure per 1 pound of TN discharged. This calculation was based on an evaluation by Dr. Hassan Mirsajadi of the Watershed Assessment Branch in consultation with Chris Brosch of the Department of Agriculture. The offset credit calculation was re-evaluated in March 2018, and starting in April 2018 the balance of the Offset Reserve has been reduced by the greater of 16.9 pounds of manure per 1 pound of TN discharged or 285 pounds of manure per 1 pound of TP discharged. This calculation (see Attachment 1) shall be used in the proposed NPDES permit. Additional relocations of manure were facilitated by the permittee in March 2018, totaling 1554.93 tons. Including the March 2018 manure relocation, approximately 1574 tons of manure remain in the Offset Reserve at the end of May 2018.

Special Condition No. 9 in the proposed permit will require the permittee to continue to implement and maintain the Nutrient Offset Plan in order to offset the small amount of nutrients (nitrogen and phosphorus) that modelling suggests is discharged to the Inland Bays from the facility.

The Offset Reserve will be reduced by the greater of 16.9 pounds of manure per 1 pound of TN discharged or 285 pounds of manure per 1 pound of TP discharged. Reporting shall be monthly as an attachment to the Discharge Monitoring Report. The special condition requires the permittee to submit an annual Nutrient Offset Report summarizing the status of the Offset Reserve. The annual report shall include calculation of the annual average usage of the offset reserve and projected usage and balance for the upcoming year. The annual report shall be submitted to the Department no later than February 15th of each calendar year.

Based on EPA policy regarding nutrient credits, offset credits utilized for compliance purposes must be generated during a contemporaneous period. In other words, credits/offsets should be created and used within the periods that are used to determine compliance with effluent limitations. This approach is consistent with Section III.G.3 of the 2003 EPA Water Quality Trading Policy. Accordingly, the use of the Offset Reserve will be phased out during the term of this permit in favor of offsetting the discharge on an annual basis. Beginning with the permit effective date and continuing through three (3) calendar years (CY 2019 - 2021), the credits remaining in the Offset Reserve will be used to offset the nutrients discharged as described previously. Beginning with the fourth calendar year of this permit (CY 2022), the Offset Reserve will no longer be used and the annual offsets shall begin. The annual nutrient discharge for CY 2022 shall be offset by manure relocation from within the Inland Bays Watershed to outside the Inland Bays Watershed in the first quarter of CY 2023 based on the annual average usage calculated in the CY2022 annual report. Manure should be removed from the Lewes-Rehoboth Canal subwatershed. If sufficient quantities of manure cannot be located from within the Lewes-Rehoboth Canal subwatershed, manure may be removed from elsewhere in the Inland Bays watershed. Nutrient offsets for subsequent years shall be handled similarly.

Biomonitoring

The current permit requires a minimum of four (4) chronic biomonitoring tests from the year preceding the NPDES permit application. Samples were collected in March 2014, May 2014, July 2014, September 2014 and October 2014. The chronic toxicity tests were performed on dilution series consisting of 6.25%, 12.5%, 25%, 50%, and 100% effluent. The following table summarizes the monitoring results submitted:

Chronic Toxicity Monitoring Results NOEC as % effluent						
Date	Mysidopsis Bahia (1007.0)			Inland Silverside (1006.0)		
	NOEC	IC₂₅	Control % Survival	NOEC	IC₂₅	Control % Survival
03/25/2014	100	100	100	100	100	100
05/06/2014	100	100	97.5	100	100	100
07/29/2014	50	100	100	100	100	100
09/09/2014	100	100	97.5	---	---	---
10/07/2014	100	100	100	100	100	100

A NOEC of 100% indicates a passing result for this facility. A confirmed NOEC of less than 100% effluent would trigger the need for a plan to reduce effluent toxicity. A control sample survival rate of less than 90% indicates an invalid test. As indicated by the above results, the NOEC for the July 2014 test for Mysidopsis Bahia indicated a NOEC of 50%. The September 2014 confirmatory test on the test species indicated a NOEC of 100%. The NOEC for three remaining tests indicated a NOEC of 100%. Additionally, all of the tests indicated 100% survival of the test organisms in the laboratory control. Based on the above results, the current biomonitoring requirements have been retained.

Storm Water Outfall (SW001)

Storm water outfall SW001 discharges collected storm water from the waste water treatment plant site. The outfall has been added to the permit in order to formally identify the outfall location and authorize continued discharge from the outfall. No monitoring is required for the outfall. Only storm water may be discharged from the outfall and the discharge must be free from floating solids, sludge deposits, debris, oil, and scum.

Special Conditions

Special Condition No. 1 states that this permit supersedes the State Permit WPCC 3075G/74 and NPDES Permit DE 0021512, issued on December 12, 2011, with an effective date of January 1, 2012.

Special Condition No. 2 outlines the industrial pretreatment program requirements applicable to this facility.

Special Condition No. 3 is a standard permit reopener clause. This special condition allows the Department to reopen and modify the permit if the discharger is causing water quality problems.

Special Condition No. 4 outlines the requirements for Chronic Biomonitoring applicable to this facility.

Special Condition Nos. 5, 6, and 7 require proper disposal of sludge in accordance with State and Federal requirements.

Special Condition No. 8 outlines wastewater treatment plant operator licensing requirements for this facility.

Special Condition No. 9 outlines the requirements of the Nutrient Offset Plan.

Special Condition No. 10 requires the permittee to continue to implement and maintain a Storm Water Plan (SWP) to minimize the discharge of contaminated storm water from its facility.

Special Condition No. 11 requires the permittee to demonstrate a minimum of 92.5% reduction in the raw waste TSS and BOD₅ concentrations on a monthly average basis prior to discharge

Special Condition No. 12 requires the permittee to use EPA-approved analytical methods that are capable of detecting and measuring the pollutants at, or below, the applicable water quality criteria or permit limits pursuant to 40 CFR Part 136.

Antidegradation Statement

The proposed effluent limitations included in this NPDES permit comply with the applicable portions of the State of Delaware Surface Water Quality Standards, Section 5: Antidegradation and ERES Waters Policies.

Public Notice and Process for Reaching a Final Decision

The public notice of the Department's receipt of the application and of reaching the tentative determinations outlined herein was published in the Wilmington News Journal and the Delaware State News on **August 22, 2018**. Interested persons were invited to submit their written views on the draft permit and the tentative determinations made with respect to this NPDES permit application. The Department did not hold a public hearing on this application since the Department did not receive a meritorious request to do so nor did the notice of this proposal generate substantial public interest. All

comments received by 4:30 p.m. on September 21, 2018 were considered by the Department in preparing the final permit.

Permit Revisions Based on Comments Received

The only comment received during the public notice period was an e-mail from Carissa Moncavage of EPA on September 19, 2018 indicating that she had completed her review of the NPDES Permit and Fact Sheet and had the following comments:

1. Part III.A.9.e of the draft permit discusses the use of the current offset reserves and the implementation of the annual offsets beginning in CY2022, however, the manure relocation requirements are unclear as they are written. The language should be revised to accurately capture the intent to the reader. We offer the following changes for your consideration:

"Beginning with the permit effective date and continuing through three (3) calendar years (CY 2019 - 2021), the credits remaining in the Offset Reserve will be used to offset the nutrients discharged as described previously. Beginning with the fourth calendar year of this permit (CY 2022), the Offset Reserve will no longer be used and the annual offsets shall begin. The annual nutrient discharge for CY 2022 shall be offset by ~~manure relocation outside~~ manure relocation from within the Inland Bays Watershed to outside the Inland Bays Watershed in the first quarter of CY 2023 based on the annual average usage calculated in the CY2022 annual report. Manure should be removed from the Lewes-Rehoboth Canal subwatershed. If sufficient quantities of manure cannot be located from within the Lewes-Rehoboth Canal subwatershed, manure may be removed from elsewhere in the Inland Bays watershed. Nutrient offsets for subsequent years shall be handled similarly."
2. Similarly, page 5 of the fact sheet includes a discussion on the use of the current offset reserves and the subsequent use of annual offsets, however, the manure relocation requirements are unclear as they are written. The language should be revised to accurately capture the intent to the reader. We offer the following changes for your consideration:

"..... Accordingly, the use of the Offset Reserve will be phased out during the term of this permit in favor of offsetting the discharge on an annual basis. Beginning with the permit effective date and continuing through three (3) calendar years (CY 2019 - 2021), the credits remaining in the Offset Reserve will be used to offset the nutrients discharged as described previously. Beginning with the fourth calendar year of this permit (CY 2022), the Offset Reserve will no longer be used and the annual offsets shall begin. The annual nutrient discharge for CY 2022 shall be offset by ~~manure relocation outside~~ manure relocation from within the Inland Bays Watershed to outside the Inland Bays Watershed in the first quarter of CY 2023 based on the annual average usage calculated in the CY2022 annual report. Manure should be removed from the Lewes-Rehoboth Canal subwatershed. If sufficient quantities of manure cannot be located from within the Lewes-Rehoboth Canal subwatershed, manure may be removed from elsewhere in the Inland Bays watershed. Nutrient offsets for subsequent years shall be handled similarly."

The above noted revisions were made to the Public Notice Draft Fact Sheet and Permit in order to clarify the original intent of the offset program.

Department Contact for Additional Information:

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Attachment 1

An approach for calculating the amount of manure removal that is needed for the City of Lewes to meet its offset requirement for its discharge of nutrients into the L&R Canal, Inland Bays

Hassan Mirsajadi, PhD – March 2018

The City of Lewes is required to offset 5% of nitrogen and phosphorus load that it discharges into L&R Canal from its wastewater treatment plant. A review of the City's Discharge Monitoring Report (DMR) indicates that the City has been overestimating the offset credit for its manure removal. This is because the City is taking credit for the entire nutrient content of the removed manure. We know that not all nutrients in the manure will reach the waters of the Inland Bays. This is because a portion of nutrients in manure applied on crop lands is utilized by plants. In addition, a portion of nutrients in manure applied on land is decayed and goes through fate and transport before reaching the waters of the Inland Bays. Therefore, a proper offset credit should be calculated based on the amount of lower nutrient loads that reaches the waters of the Inland Bays as the result of manure removal.

In what follows, we propose one method for estimating the amount of manure removal that is needed in order to satisfy the City's offset requirement based on water quality improvement that manure removal is expected to result. Since the City is discharging both nitrogen and phosphorus, we need to calculate the amount of manure removal that will be needed to offset the impact of discharge of each nutrient separately and determine the amount of manure removal which would satisfy the offset requirement for both nutrients.

In calculations below, we use some of the loading rates and relative loading rates that are generated by the Chesapeake Bay Program to calibrate the Phase 6 Chesapeake Bay Watershed Model.

A. Nitrogen

1. The amount of manure that is generally applied on agricultural land in the Inland Bays watershed (for agricultural lands that have nutrient management plan) is between 2.0 and 2.5 tons/acre/yr (personal communication, Chris Brosch, Delaware Dept. of Ag.). We will use an average value of 2.25 tons/acre/yr for this calculation.

When manure is no longer applied to an agricultural crop land, the nitrogen loading rate is reduced from 54.7 lbs/acre/yr to 39.07 lbs/acre/yr (Ches. Bay Program, Phase 6 Watershed Model Report, Table 2-7, Page 2-9). Based on the above loading rates, eliminating manure application from a corn field will reduce TN loading rate by:

$$54.7 - 39.07 = 15.63 \text{ lbs/acre/yr}$$

2. The amount of nitrogen loading rate reduction estimated above is for the edge of the field and at the farm site. Decays and fate and transport of nitrogen in the streams network of the Inland Bays is expected to reduce the effect of this load reduction by 10% to 20% by the time nitrogen from the edge of the farm reaches the waters of the Inland Bays. Assuming a 15% decay, the true benefit for the waters of the Inland Bays from converting an agricultural crop land with manure application to a crop field without manure application is expected to be:

$$15.63 \text{ lbs/acre/yr} * 0.85 \text{ (percentage of N load reaching the Inland Bays)} = 13.29 \text{ lbs/acre/yr}$$

3. Per NPDES Permit for the City of Lewes, for each pound of nitrogen discharged from the City's WWTP, 0.05 lbs of nitrogen needs to be offset.
4. Considering the 2 and 3 above, the acreage of land this is needed to be converted from manure application to no manure application in order to achieve 0.05 lb of nitrogen reduction in one year is:

$$\frac{0.05 \text{ lb}}{13.29} = 0.0038 \text{ acres}$$

5. The amount of manure that is applied to the acreage of ag land calculated in 4 above is:
 $0.0038 \text{ acre} * 2.25 \text{ tons/acre} = 0.0084 \text{ tons} = 16.93 \text{ lbs}$

This means that for every pound of nitrogen discharged from the City of Lewes WWTP, 16.93 lbs of manure need to be removed to offset the impact of discharge of nitrogen on the Inland Bays.

As an example, the City's DMR report shows that during the month of October 2016, a total of 1,351.24 lbs of nitrogen was discharged from the City's WWTP. The amount of manure that needs to be removed to offset this N discharge is:

$$1,351.24 \text{ lbs N} * 16.93 \text{ (lbs of manure for every pounds of N discharge)} = 22,877 \text{ lbs} = 11.44 \text{ tons}$$

B. Phosphorus

1. For phosphorus, Table 2-8, Page 2-12 of the Ches. Bay Program, Phase 6 Watershed Model Report shows a loading rate of 1.87 lbs/acre/yr for crop lands. This value is for an crop land with a relative loading rate of 1.0, which is for corn without manure application. Table 2 of the Appendix for Chapter 2 of the Chesapeake Bay Program Phase 6 Watershed Model Report lists relative loading rates for corn grain fields without manure as 1.0 and with manure application as 1.5. Considering these relative loading rates, the loading rate for a corn field with manure application will be:

$$1.87 \text{ lbs/acre/yr} * 1.5 = 2.80 \text{ lbs/acre/yr}$$

Based on the above loading rates, eliminating manure application from a corn field will reduce the TP loading rate by:

$$2.80 - 1.87 = 0.93 \text{ lbs/acre/yr}$$

2. Similar to the case for nitrogen, the amount of phosphorus loading rate reduction estimated in the above is for the edge of the field and at the farm site. Decays and fate and transport is expected to reduce the effect of this load reduction. Assuming a 15% decay (as was assumed for nitrogen), the true benefit of P reduction for the waters of the Inland Bays from converting an agricultural corn field with manure application to a corn field without manure application is expected to be:

$$0.93 \text{ lbs/acre/yr} * 0.85 \text{ (percentage of P load reaching the Inland Bays)} = 0.79 \text{ lbs/acre/yr}$$

3. Per NPDES Permit for the City of Lewes, for each pound of phosphorus discharged from the City's WWTP, 0.05 lbs of phosphorus needs to be offset.
4. Considering 2 and 3 above, the acreage of land this is needed to be converted from manure application to no manure application in order to achieve 0.05 lb of phosphorus reduction in one year is:

$$\frac{0.05 \text{ lb}}{0.79} = 0.063 \text{ acres}$$

5. The amount of manure that is applied to the acreage of agricultural land calculated in 4 above is:
 $0.063 \text{ acre} * 2.25 \text{ tons/acre} = 0.142 \text{ tons} = 285 \text{ lbs}$

This means that for every pound of phosphorus discharged from the City of Lewes WWTP, 285 lbs of manure need to be removed to offset the impact of P discharge on the Inland Bays.

As an example, the City's DMR report shows that during the month of October 2016, a total of 383.16 lbs of phosphorus was discharged from the City's WWTP. The amount of manure that needs to be removed to offset this P discharge is:

$$383.16 \text{ lbs P} * 285 \text{ (lbs of manure for every pounds of P discharge)} = 109,200 \text{ lbs} = 54.60 \text{ tons}$$

Conclusion:

The above calculation shows that for the month of October 2016, in order to satisfy the offset requirement for N discharge, 11.44 tons of manure needs to be removed. For the same month, in order to satisfy the offset requirement for P discharge, 54.6 tons of manure needs to be removed. The offset requirement for the month of October 2016 will be the higher of the above two values. Therefore, for the month of October 2016, 54.6 tons of manure needs to be removed to meet the offset requirement for the City of Lewes discharge of both nitrogen and phosphorus.